# A study about optimized seed orchard design: form mathematical modeling to algorithms

A seed orchard function just as its name. It is a plantation be designed to produce seeds for the establishment of new forests. It usually consists of same species trees with different genetic features. The significance of seed orchard design (SOD) emerges from features of tree's long production cycle and unchangeable placement which means risks caused by spatial allocation including reduction in production and next generation's genetic quality will be long existence and unchangeable. Based on past experiences, mating between genetically related parents (copies of the same individual or share common ancestors) is the major cause of risks. The needs of lifting production and lowing inbreeding risks calling for new SOD methods. The study developed a new method using breeding value as the calculating object for maximizing seed orchard's overall production and lower risk of inbreeding. Our model first considers an important element—pollen dispersal. We also introduced "quadratic assignment problem", an operational research problem which is naturally matched with our optimization goal. Heuristic algorithms are commonly used in our study to reduce the optimizing time. The design was compared with the commonly used design and the completely randomized design to illustrate usefulness.

## Summary

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